Using K-12 Schools to Promote Sustainable Communities

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Introduction

Schools are a heavily talked about topic. The history, quality, and future of schools is something of much interest to many people regardless of whether or not they have children. The majority of our taxes go to support schools and education. With such a large emphasis on schools, it was a topic I wanted to dive into to better understand how city planners plan for schools. This report summarizes my findings on how can retrofitting schools promote community sustainability.

The report is organized by a background on public education including the history of public education in the United States, the history of housing as it relates to schools, and the history of public school design. Then, the report transitions to the status of public schools today, which looks at public school infrastructure in the United States, the Georgia Department of Education, and Atlanta Public Schools. A literature review gives three examples of policy initiatives, school siting requirements, and retrofitting existing infrastructure. The next step to my research was to interview current professionals in the fields to better understand the obstacles each group faces. I interviewed individuals from the *U.S. Green Building Council, the previous Director of the Atlanta Mayor's Office of Sustainability, the* Vice President of Programs and Sustainable Growth at the Georgia Conservancy, an elected official at the Atlanta School Board, and the Executive Director of Facilities Services at Atlanta Public Schools. Next four case studies examined school design, sustainable educational programs, and comprehensive school planning. Finally, the report concludes with the analysis of my findings.

The goal and objective of this paper is to understand the importance of reusing existing facilities when planning for future student and population growth and how the City of Atlanta and Atlanta Public Schools can work together to achieve this goal.

Background

History of Public Education in the United States

The United States public school system was built after 13 colonies decided to come together and form a nation. Prior to the 1840's, the education system was primarily available for wealthy people and was based on religious regions. A system of tax-supported schools that would combine cultures and backgrounds to reinforce democracy was the goal set out by Thomas Jefferson.[1] He wanted education to be under government control, free from religion, and available to all people. This was a controversial topic during this time because people were concerned about taxation. Jefferson had support for his idea about public education from Benjamin Rush, Noah Webster, Robert Coram, and George Washington.[2] By the end of the 19th century, these reformers were able to free public education at the elementary level.

The state of Massachusetts passed the first compulsory school attendance laws in 1852. By 1918, all states had passed mandatory attendance laws requiring children to attend elementary school. The rise in American high school attendance rose greatly in the 20th century.[3] Public school in the United States grew dramatically from 1900 to 1945, the end of World War II. In 1900, only 6% of American children graduated from high school whereas 51% of children graduated from high school in 1945. Throughout the 20th century, many states passed legislation that would extend mandatory education attendance to 16 years old.

Many historical events happened during the formation of the public education system including The Great Depression, World War II, the Cold War, other wars, the civil rights movement, student protests and many political events within the United States. During the 1920-1930's, the focus in education was on "progressive education" which focused on quality education and curriculum development.

Postsecondary education also grew dramatically during the 20th century. From 2% of Americans at the beginning of the century to over 60% of Americans by the end of the century had enrolled in colleges and universities across the United States. Thanks to the Morrill Acts of 1862 and 1890, federal land and funding was given to states for education. The increased access to education lead to further student enrollment in universities and colleges as well as research. Similar to primary and secondary education, postsecondary education grew substantially after World War II.

Schools are governed by the state and local levels. They rely heavily on local property taxes to meet the majority of school expenses such as buildings, teacher salaries, materials, and support staff. As a result, "schools tend to reflect the educational values and financial capabilities of the communities in which they are located."[4] After World War II, many states took a more active

[1] "School: The Story of American Public Education | Facing History and Ourselves."
[2] Thattai, "A History of Public Education In The United States."
[3] Thattai.
[4] Thattai.

regulatory role where they consolidated school districts from more neighborhood level size to larger units with common procedures. In 1940, there were over 117,000 school districts in the United States. In just fifty years, this was reduced to 15,000 school districts by 1990. During this time states became more responsible for providing the financial means for education. “In 1940 local property taxes financed 68% of public school expenses, while the states contributed 30%. By 1990, local districts and states each contributed 47% to public school revenues and the federal government provided the remaining funds.”[5] Further federal financing was given when Congress passed the National Defense Education Act of 1958 and the Elementary and Secondary Education Act of 1965. These two regulations expanded educational opportunities for children from low income families and focused on improving instruction in science, math, and foreign languages.

The majority of public policy since the 1950s has primarily addressed equality in gender, race, and economic class throughout education and school districts.[6] “Segregation usually resulted in inferior education for blacks. Average expenditures for white schools exceeded expenditures for black schools. Teachers in white schools generally received higher pay than did teachers in black schools.”[7] This equity divide was also seen through the difference of pay for teachers between white and black schools as well as the quality of facilities. In 1954, the case of Brown vs. Board of Education ruled against racial segregation in public schools declaring it to be unconstitutional. Even though the supreme court ruled against school segregation, it didn’t completely eliminate the practice of discrimination. Many other factors were also fighting the discrimination battle including white flight, sprawl, and redlining in suburbs. Many whites had moved out of the central city leaving low-income African American families and rising populations of Hispanic Americans in the 1970s. Middle class African American families who were able to move out to the suburbs were faced with redlining discrimination when trying to buy a house. This affected the diversity of schools in the suburbs because schools were populated by school districts. Since neighborhoods were not diverse, schools were also not diverse in family income and race.

Public education has come a far way since the inception in the mid 19th century. Public education has evolved with diversity of income, race, and gender, and continues to evolve with the advancement of technology and learning methods. Although many more programs, plans, and regulations have continued to change the current education system, it is foolish to not examine how the built environment has directly affected our education system. Thattai’s concluding thought in her *History of Public Education in the United States Editorial Summary* was “it is eventually the role of the public that should influence public education, which is not much prevalent now.”[8]

[5] Thattai.
[6] Thattai.
[7] Thattai.
[8] Thattai.

History of Housing as it Relates to Schools

"In the 1930s, as part of the New Deal, FDR created loan programs to help Americans finance their homes. But to decide who got the loans the government created color coded maps where green neighborhoods were good and red neighborhoods were bad. This practice became known as redlining."[9] Redlining systematically prevented African Americans, Hispanics, and other minorities from buying homes.[10] William Levitt who developed early suburbs such as Levittown, established racist policies against minorities.[11] The federal government encouraged this style of development and racist policies.[12] Between 1934-1968, 98% of home loans were given to white families.[13] This advantage compounded over time. The families in the white neighborhoods were able to buy homes and accrue wealth. People in the minority neighborhoods, or the redlining neighborhoods, did not have the same opportunities. The increase in wealth in white neighborhoods attracted local businesses and therefore causing property values to rise.[14] This gave white families the opportunity to sell their homes and send their children to college, which would pass down their wealth and advantages to future generations. The minority neighborhoods had less ability and opportunities to gain wealth, keeping them in poverty longer.[15] The effect of the racism from the 1930's continues as we can see only 1% of Levittown is black today.[16] If the neighborhoods are segregated, the schools are too.

A New York Times writer who typically covers housing and school segregation issues explains how the suburbs and segregation are tied together today. Black children are more segregated now than they were in the 1970s. Since schools are largely funded by property taxes in the United States, schools continue to be segregated by socioeconomic class. This also means that since property values in white neighborhoods are much higher, their schools get more money to spend on facilities, teachers, and supplies. This starkly contrasts minority schools which are really under funded, are the least likely to have AP courses, and experienced and qualified teachers.[17]

History of Public School Design

School buildings can be looked as an icon or symbol for the values we hold together as a society, making the design of these facilities an important topic. It's important to understand the history of these facilities as they have evolved in our society due to the political and social movements, new technologies and trends, and the changing built environment. Specific consideration has been given to lighting, heating, cooling, ventilation, and acoustics in schools. In the article *A History of School Design and it's Indoor Environmental Standards, 1900 to*

[9] Madrigal, "The Racist Housing Policy That Made Your Neighborhood."
[10] Bouie, "How We Built the Ghettos."
[11] Loewen, *Sundown Towns: A Hidden Dimension of American Racism*.
[12] Lambert, "At 50, Levittown Contends With Its Legacy of Bias."
[13] Fresh Air, "Historian Says Don't 'Sanitize' How Our Government Created Ghettos."
[14] Badger, "Redlining."
[15] Surowiecki, "The Widening Racial Wealth Divide."
[16] Lambert, "At 50, Levittown Contends With Its Legacy of Bias."
[17] Hannah-Jones, "Segregation Now."

Today, the author cites a turn of the century author who stated "[t]he school building should be simple, dignified and lain and should be built of the most enduring materials procurable; first because this contributes to safety, permanence and endurance, and second because the true character of the building will be best expressed through such materials."[18] The author later explains how "[i]n the decades that would follow, those writing about school facilities would speak with similar passion and assurance that schools needed to follow quite different principles, from the need to be open to the air, to the need to be quickly built, and to the need to provide space for multiple modes of instruction."[19]

The evolution of classroom designs in the United States can be grouped together largely by historical events. From 1870 to 1914, the second industrial revolution characterized school design by raised platforms for instructors and students were arranged in fixed desks that were many rows deep.[20] Early attempts at standardizing school design were helpful in creating a typical construction basis for schools which was of great value when school enrollment increased and towns and cities had a responsibility to educate students after the compulsory attendance laws were passed in all states by 1918. During this influx of school construction in the United States, many classrooms were utilitarian, designed to maximize space and house a large number of students. Fresh air, ventilation systems, and heating suggestions were made for schools. In "*A History of School Design and its Indoor Environmental Standards, 1900 to Today"* the author explains that during this time, ventilation requirements for classrooms were a "supply of 30 cubic feet of fresh air per minute for each pupil up to the maximum number allowed for the room in question; while the heating plant should be adequate the raise the temperature to 70 Fahrenheit in zero weather." The author later explains how larger classrooms, especially ones "in urban areas, were growing increasingly reliant on artificial ventilation." Early daylighting in schools was incredibly important as the lack of electricity for light was a major consideration. "A number of scholars point out that 'Light should come over the left shoulder of each pupil,'" which could correlate with the low number of left handed students during this time. When electrical lighting was introduced into classrooms, incandescent bulbs were used which had a large cost, logistical challenges, and produced a lot of heat. "In 1918, the Illumination Engineering Society published the *Code of Lighting School Buildings*, which called for *3 footcandles minimum* of artificial light in classrooms, nothing that "ordinary practice" was more in the range of 3.5-6.0 footcandles."[21]

[18] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."
[19] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."
[20] Brite, "A Continuing Education."
[21] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."

Figure 1: Wiley Elementary School, Raleigh, North Carolina, 1924.[22]

The education reformers of the 1920s and '30s during the Great Depression in 1929 tried to soften the utilitarian approach in schools with daylighting techniques, views of the outdoors, and rearrangement of desks.[23] "Many new schools during this time were built with funding from the Public Works Administration, which provided financing for 70% of new school construction for local communities."[24] A movement known as "open aired schools" that focused on air, light, outdoor learning, and building circulation became popular during this time. Schools had floor to ceiling windows and a greater connection to the outdoors. "This decade saw the creation of the National Council on Schoolhouse Construction which would become today's Council of Educational Facility Planners International, a trade group for those who design and maintain school buildings." Lastly, "there were fewer significant strides made in the development of indoor environmental quality (IEQ) standards during this era, roughly due to the depression and the difficulties the building industry was going through at a time that due to economic problems and then the start of World War II. However, significant changes were about to hit, as the nation emerged from the war in 1945."[25]

The World War II era from 1939 to 1945 gave a population boom and increased school construction. This large influx of students gave a wave of growing infrastructure needs which meant design and quality of construction was less of a concern.[26] The post war baby boom had a tremendous impact on school facilities as seven million children began school within a small window. It was estimated that ten billion dollars were needed for new school construction within a 10 year window, which greatly concerned parents and taxpayers.[27]

The civil rights movement during the 1950s challenged schools' traditional row-and-column layouts. School desegregation lead to open classrooms that were free of walls and the students

[22] Nelson, "School Design Through the Decades."
[23] Brite, "A Continuing Education."
[24] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."
[25] Baker.
[26] Brite, "A Continuing Education."
[27] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."

were reorganized into groups by subject matter.[28] World War II had a strong financial effect on schools during this time. Twenty billion was spent on new educational facilities from the end of World War II through 1964 as the student population rose by 2.3 million students in the decade between 1958 and 1968.[29] School districts were following new school design trends such as steering away from the classical, colonial, Georgian, and Gothic architectural styles and were transitioning to more modern, one story buildings. As schools transitioned away from two- or three-story brick buildings to lightweight construction, they were cheaper and faster to build, which resulted in schools with a shorter life expectancy. Continued research was performed during this time around the topics of visual comfort, ventilation, and thermal comfort.

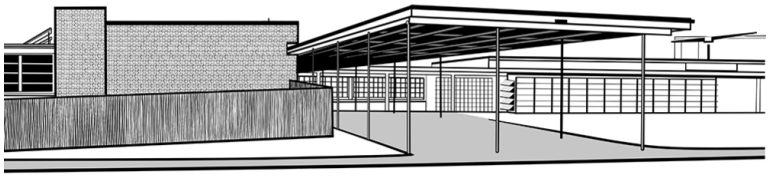

Figure 2: McDonogh 39 Elementary School, New Orleans, 1952.[30]

During this time, the finger-plan school design gained popularity and was the school building that more than any other defined modern educational architecture in the United States.[31] An example of this school building style is the Crow Island School which was designed by Perkins+Will and opened right before the boom occurred. The plan of the school had “corridors spread out across the plan, forming fingers off of which each classroom extends. This configuration allowed each classroom to have access to maximum amounts of fresh air and light, and allowed for many classrooms to have direct access outside through exterior doors.”[32]

[28] Brite, “A Continuing Education.”
[29] Baker, “A History of School Design and Its Indoor Environmental Standards, 1900 to Today.”
[30] Nelson, “School Design Through the Decades.”
[31] Baker, “A History of School Design and Its Indoor Environmental Standards, 1900 to Today.”
[32] Baker.

Figure 3: Crow Island School, Winnetka, Illinois, 1940.[33]

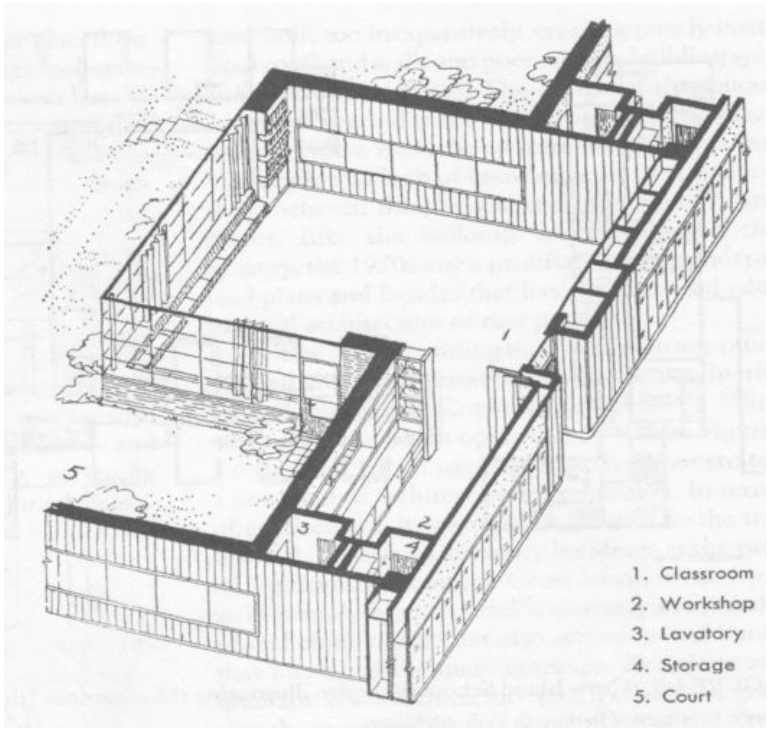

Figure 4: Crow Island School Floor Plan, Winnetka, Illinois, 1940.[34]

In 1973, the Section 504 of the Rehabilitation Act requires schools to accommodate individuals with disabilities. This coincided with school design research that argued for single story buildings because “multi-story buildings are more difficult to evacuate than single-story buildings.”[35] The baby boom post World War II was also subsiding, causing many school districts to struggle as student rosters and school funding were decreasing. This caused schools

[33] Perkins+Will, “Crow Island Elementary School.”
[34] Peterson, *Picturing Meaning*.
[35] Baker, “A History of School Design and Its Indoor Environmental Standards, 1900 to Today.”

to re-think and reconfigure existing school space to accommodate their shifting populations.[36] This also coincided with the "fundamental shift to desegregated schools, which had a profound impact on equity issues in schools, especially in urban areas."[37] Facilities that were built during the 1940s and 1950s were aging and in need of investment and renovation, however, the declining school budgets of this time did not lend themselves to the much needed school building maintenance.[38] During the 1970s Energy Crisis, energy conservation was gaining popularity, which resulted in schools transitioning to electric lighting and mechanical conditioning. The designs of schools also reflected energy conservation methods through brutalist architecture by closing off large windows in the hopes of saving additional energy.[39]

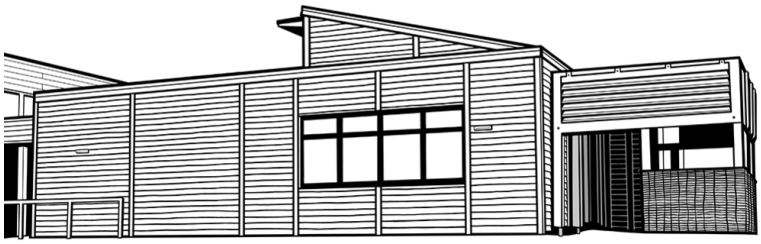

Figure 5: Winkleigh Primary School, Devon, 1970s.[40]

In the 1980s, many portable classrooms were "installed on school grounds due to difficulties in enrollment projections and other population changes.However, by the late 1990s, it was becoming increasingly obvious that these "temporary" classrooms were not so temporary after all."[41] Concerns about portable classrooms were centered around the indoor environmental quality, the long term sustainability, and the growing number of these types of classrooms across the United States.

> "In 1995, a comprehensive report was published by the General Accounting Office on the sad state of school facilities in the U.S. In this report, they estimated that $112 billion was needed just to bring the nation's school facilities up to "good overall condition". Much of this was for projects like asbestos removal, basic compliance with the Americans with Disabilities Act (ADA), and recently discovered problems with lead in the water supply. The report told many horror stories, like that of raw sewage leaking into a school's front lawn due to broken plumbing, and collapsing ceilings due to water damage in another. This report was very helpful for advocates looking for federal and state-level

[36] Baker.
[37] Baker.
[38] Baker.
[39] Brite, "A Continuing Education."
[40] Nelson, "School Design Through the Decades."
[41] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."

support for school facilities, but no direct federal policies or assistance resulted from the release of the report."[42]

It was a challenging time for schools as much of the public school infrastructure was either crumbling due to a lack of maintenance or a lack of initial investment such as portable classrooms.

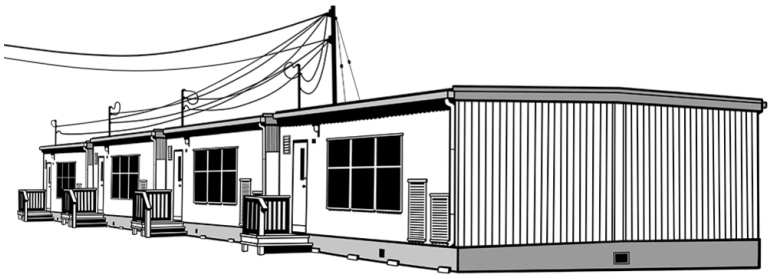

Figure 6: Portable classrooms at Pierre Elliott Trudeau High School in Markham, Ontario, Canada.[43]

Schools prioritized energy efficiency and indoor air quality in the late 1990's which coincided with the U.S. Green Building Council (USGBC) launching LEED in 1998. This continued into the 2000s when the USGBC introduced LEED for schools which focused on creating energy-efficient and crime-deterring classrooms.[44] This however was focused on new construction, and does not address existing school buildings. This helped introduce small renewable energy systems, such as solar panels, in schools.[45] Ironically, during this period of energy efficiency and the trends toward LEED, LEED building ratings do not focus on internal energy efficiency of the building once the building is built and is being used. Instead, LEED has a greater focus on the construction of the building, but that's a small part of the greater lifetime usage of the building.

[42] Baker.
[43] Nelson, "School Design Through the Decades."
[44] Brite, "A Continuing Education."
[45] Baker, "A History of School Design and Its Indoor Environmental Standards, 1900 to Today."

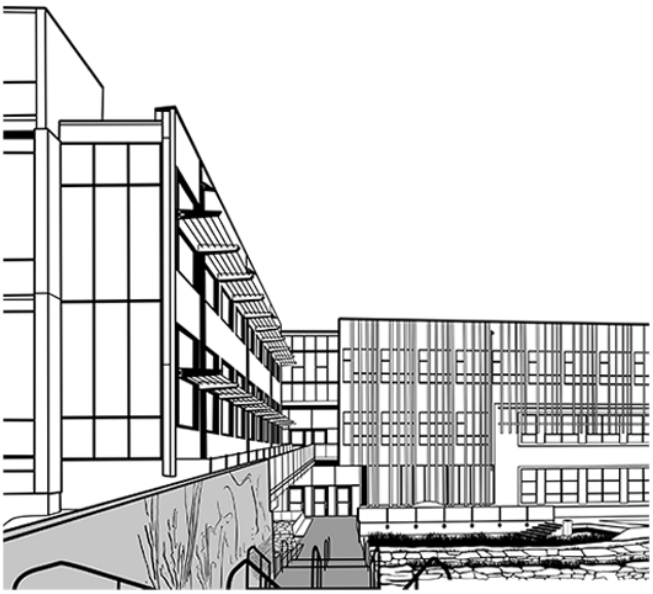

Figure 7: Sidwell Friends School, Middle School building, Washington DC, 2006.[46]

Today, schools continue to venture into the sustainable design space. Since 2010, Living Buildings and Smart Academic Green Environment (SAGE) schools have become a popular building type.[47] In the coming decades we can expect a greater integration with technology, space organizations that reflect flexibility, and a greater tie to building performance usage metrics. As we continue to build more energy efficient schools, our greatest challenge will be successfully monitoring the active use of buildings, educating and communicating with occupants about building usage, and tuning and maintaining systems so they will function as planned.[48]

[46] Nelson, “School Design Through the Decades.”
[47] Nelson.
[48] Baker, “A History of School Design and Its Indoor Environmental Standards, 1900 to Today.”

Public Schools Today

Public School Infrastructure in the United States

Today, schools are the second largest national infrastructure sector in the United States, only coming in second to highways. The US Green Building Council published a 2016 report called the State of Our Schools which outlines the funding gaps in schools across the state.[49] The report analyzes 20 years of national and state data on public spending from 1994-2013 and reviews the spending on maintenance and operations. The scarcity of national standards for public school infrastructure has left cities and states to create their own public school infrastructure standards.[50] The maintenance and capital improvements are underfunded, leaving students with unsatisfactory learning environments. The figure below shows the percentage of total state and local capital outlay between 1995-2012. It illustrates almost a quarter of state and local infrastructure investments go into K-12 facilities. The only category to receive more infrastructure investments is highways.

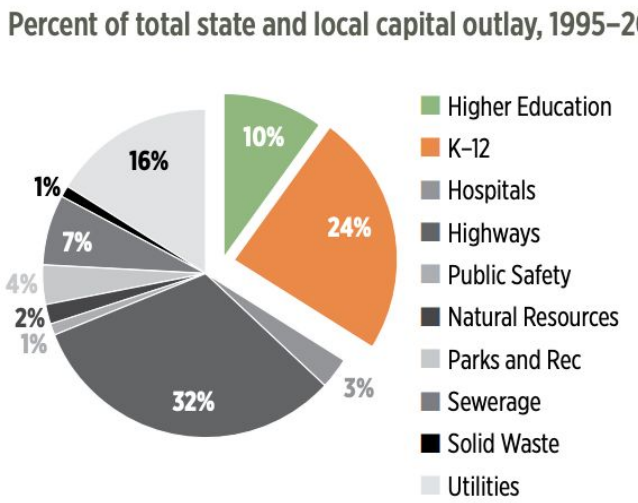

Figure 8: Percent of total share and local capital outlay, 1995-2012[51]

The USGBC report outlines 3 steps as part of their call to action which include to “first, understand current facility conditions, second, engage communities in planning for adequate and equitable 21st century facilities, third, find and pilot new innovative sources of public funding, and fourth, leverage public and private resources in new ways to assist states and districts.” There is still much to do to bring US public schools up to 21st century standards, but this current void leaves a space for further community integration, participation, and improvement as well. School districts are an important part in managing facilities to be more environmentally conscious by reducing the use of natural resources, supporting the local ecology and resilience, and promoting a positive public health.

[49] United States Green Building Council, “State of Our Schools.”
[50] United States Green Building Council.
[51] United States Green Building Council.

Georgia Department of Education

The State of Georgia has 2,302 schools, which is broken down into 1,322 elementary schools, 482 middle schools and 482 high schools.[52] According the the Georgia Department of Education, the Georgia state law (20-2-260) "requires all school systems to develop and maintain a comprehensive facilities plan that is updated every five years to be eligible to participate in Georgia's Capital Outlay Program."[53] The rigorous program is supported by DOE staff and consultants so school systems get both technical assistance and support when developing these comprehensive plans.

The size of a school is determined by state regulations and is not federally mandated. In the State of Georgia, a law called the Georgia Quality Basic Education Act, or QBE, oversees how the state funds local schools. The law was originally intended to make school funding more equal among the state. The law was enacted in 1985 under Democratic Governor Joe Frank Harris. In the white paper "Georgia Statutes that Affect School Siting Decisions," the author Scott B. Fields explains the how the size of schools was determined by Georgia laws that set minimum sizes schools must reach in order to receive capital funding and salary funding from the state. As a result, "these minimum size requirements for full funding strongly incentivize school systems towards school consolidation and larger sizes."[54]

Historically, most school systems used local revenue from property taxes as the primary source for renovating and modifying existing facilities and the construction of new schools. The two available options for school funding put the burden directly on property owners to provide adequate local funding for capital improvements. As property taxes are fueled by successful businesses, higher prices of homes, and essentially, more community wealth, the neighborhoods with more money get better schools and neighborhoods with less money have worse schools.[55] Additional funding can be accumulated if the local boards of education (LBOE) call for a referendum to ask voters to approve a special-purpose local-option sales tax (SPLOST) for a 1% sales tax for a maximum of five years.[56] The SPLOST revenue is later divided based on the FTE (full-time equivalent) count prior or the referendum on imposing the tax.

An organization called [Re] Build America's School Infrastructure Coalition (BASIC) is focused on modernizing America's public school infrastructure. BASIC outlines the State of Georgia's funding gap over the next ten years, from 2018-2027 to be an estimated $42 million. They predicts $18.94 billion will be required and the average spending is 16.41 billion, leaving a deficit of $0.42 billion.[57]

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[52] Georgia Department of Education, "Office of Technology Services-School Directory."
[53] Georgia Department of Education, "Facilities Services."
[54] Fields, "Georgia Statutes That Affect School Siting Decisions: How QBE Influences School Size."
[55] NPR, "Week 1."
[56] Georgia Department of Education, "SPLOST."
[57] BASIC, "Challenge."

The Georgia Department of Education has strict rules for minimum facility requirements, Guidelines for Public Educational Facility Construction, Guidelines for Submission of Documents for Review of Planning, Bidding, and Construction of Educational Facilities, Guidelines for Square Footage Requirements for Educational Facilities, Guidelines for Educational Facility Site Selection, and Guidelines for Total Modernization of a Building all available on their website. The various guidelines provide extensive requirements and suggestions for renovation and new construction of school buildings.[58]

This leads to the question of what's being done about school renovations and new construction. A closer examination of Atlanta's schools will unveil some of the strengths and weaknesses of the Atlanta Public School (APS) systems approach to school renovations and new construction.

Atlanta Public Schools

The City of Atlanta has a total of 45 elementary schools, 11 middle schools, 2 middle/high schools, and 10 high schools. There are a total of 89 different learning sites that house approximately 52,000 students as seen in figure 9 below.[59] APS also has a total of 34 vacant properties as seen in figure 10 below. The school's range in date of construction as some schools were built in the mid 1800's and others are new construction. As some of the vacant schools lied dormant, time persisted and new life was given to a few schools as they were repurposed into lofts, apartments, The Center for Puppetry Arts, and additional classrooms for Georgia Tech.[60]

In the past 20 years when the United States has seen a lot of reinvestment in schools, Atlanta Public Schools has been no exception. APS has won several awards for design, sustainability, and construction across many of their facilities and as of April 2014, APS had 10 LEED certified projects. In 2015, APS completed Facility Assessment Reports on all of the facilities as part of the Georgia State Law that requires schools to do comprehensive facility planning every five years as part of the Georgia's Capital Outlay Program. APS is due for another facility planning in 2020, so recommendations can be found in the analysis section of this report. Although, APS is diligently working to provide a high quality environment to their students, teachers, and staff, there is still room for improvement.

[58] Georgia Department of Education, "Facilities Services."
[59] Atlanta Public Schools, "About Our Schools."
[60] Kahn, "Mapping Atlanta's Cool, Repurposed Old School Buildings."

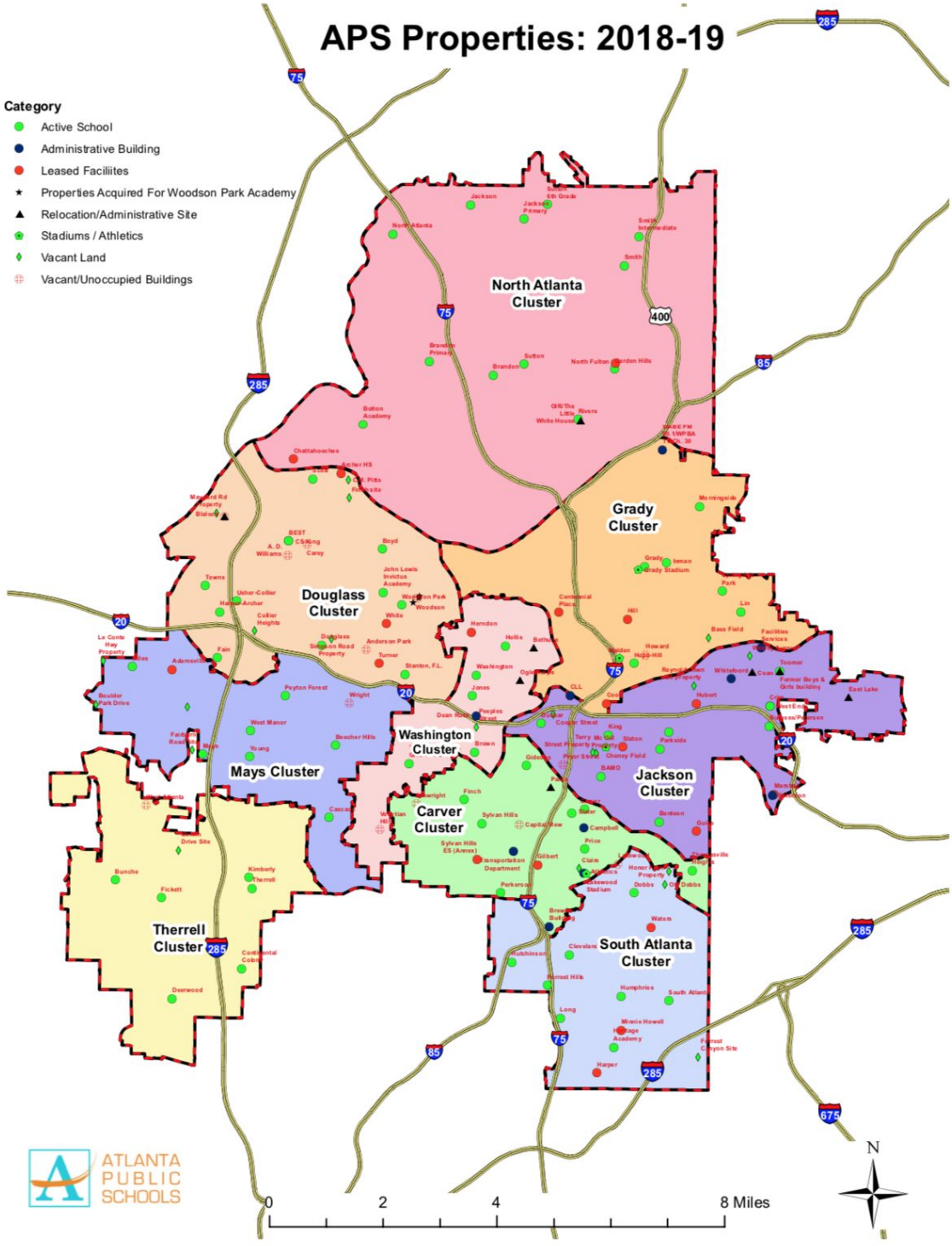

Figure 9: Atlanta Public Schools Properties as of 2018-2019

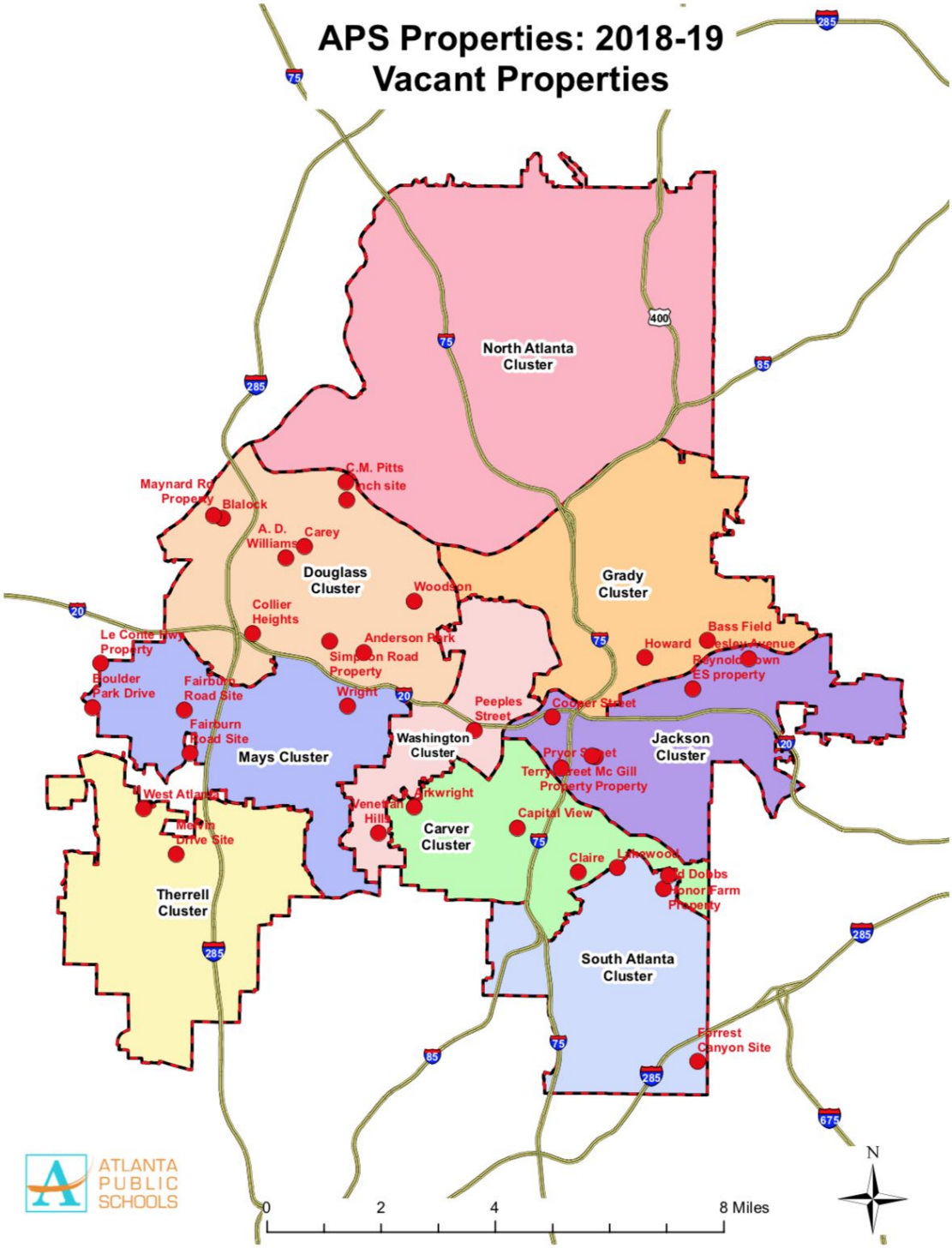

Figure 10: Atlanta Public Schools Vacant Properties

Literature Review

New York City Public School Policy Initiative

Education in already dense or urban areas poses the questions about real estate, access, and funding.[61] New York City is well versed in this topic as it has the largest school district in the United States with over 1.1 million students and has 1,840 schools. As a result, New York State Legislature created the Educational Construction Fund (ECF) in 1967. The mission behind the ECF is to build safe public schools. They encourage comprehensive neighborhood development by focusing on mixed-use real estate projects that also include school facilities.[62] The ECF is both a financing and development vehicle. ECF builds combined-occupancy structures on city-owned land conveyed to the ECF by the City of New New York and is financed by the issuance of tax exempt bonds. "EDF uses ground rents, lease payments and/or tax equivalent payments from the non-school portion of projects to finance construction of the school facility. Through these innovative public-private partnerships, ECF is able to allow the City of New York to accomplish more than it otherwise would be able to."[63]

One of the challenges of the New York City EDF is that the cross subsidization of public benefits would only work in high-priced locations. In order to create these community and educational benefits in low-market neighborhoods, which tend to be in greater need of new schools and affordable housing, the model would require whatever additional federal, state, or municipal financing was available. In an article titled *The Private Lives of Public Schools,* Susanne Schindler explains "in a geographically determined realm like education, this can amount to public investment that exacerbates, rather than reduces, inequality."[64] It is difficult for school systems to predict and account for growth as families move and neighborhoods come and go out of trends.

Retrofitting Infrastructure

Project Oasis is a "non-governmental organization (NGO) made up of Masters students who are studying Development Economics and International Project Management at the Université Paris XII-Créteil, as part of the Field Mission project established in the curriculum." The aim of these innovative designers is to turn "concrete schoolyards of Paris into 'islands of cool.'[65] These masters' students integrate social, economic, and environmental elements, which are the three primary parts of sustainability. The Project Oasis sets out to retrofit these existing heat-absorbing spaces into vibrant green spaces. Inner city schools in Paris are devoid of vegetation and the natural ecology. Paris has notably less green space than other large European cities.[66] The project is broken into two main parts including removing the concrete, asphalt, and other impervious surfaces and replacing them with native plants and water in

[61] Schindler, "The Private Lives of Public Schools."
[62] "Educational Construction Fund."
[63] AvalonBay Communities, "The New York City Educational Construction Fun (ECF)."
[64] Schindler, "The Private Lives of Public Schools."
[65] Weedy, "Students Creating 'Islands of Cool' for Paris Schoolyards in Summer."
[66] Hickman, "How Turning Gray Schoolyards Green Could Help Cities Cool Off."

schoolyards. They plan on using this new environment as a learning tool for students. The second part of the project is to "open these 600,000 square meters (nearly 6.5 million square feet) of schoolyards to the public."[67]

School Siting

The location and siting of schools is important to planning and ensuring we develop sustainable communities. The location of schools is vital to community development as it affects commutes and traffic congestion, public health and well-being, taxes and property values, and community equity and quality. In Georgia, school siting is problem as schools are planned in school districts with little consideration to city planning. Public schools are planned without coordinating with city officials on land use, transportation, urban design, community development, and environmental goals. This disconnection provides an opportunity for collaboration and discussion at the city and state levels when discussing school development and placement.[68]

New schools are typically built on greenfield sites which is typical to smaller towns throughout Georgia. Atlanta has several occupied and vacant buildings and properties across the city, so they are less likely to build on greenfield sites. "Georgia's school financing policies and minimum acreage requirements are driving school districts to build new schools that are larger and farther from the communities they serve."[69] The Quality Basic Education Act (QBE) has a large impact on K-12 schools today as it requires schools to have minimum acreage requirements and minimum student requirements in order to qualify for funding. The funding directly supports the construction, modification, and renovation of schools as well as teacher and staff salaries. The minimum acreage requirement makes it difficult for school districts to find large plots of land in city centers, which forces them to build on lots towards the edges of towns and further promotes sprawl as seen in figure 11 and 12.

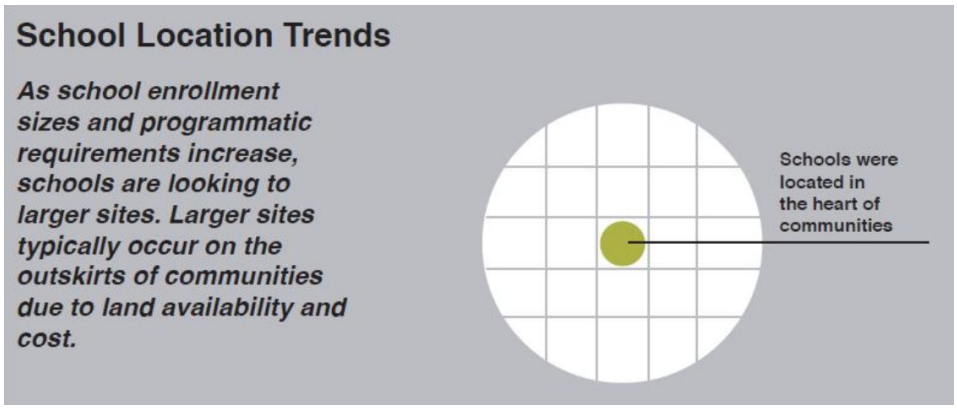

Figure 11: School location trends. Schools were previously located in the heart of communities.[70]

[67] Hickman, "How Turning Gray Schoolyards Green Could Help Cities Cool Off."
[68] Georgia Conservancy, "School Siting White Paper."
[69] Georgia Conservancy.
[70] Georgia Conservancy, "School Sitting Blueprints."

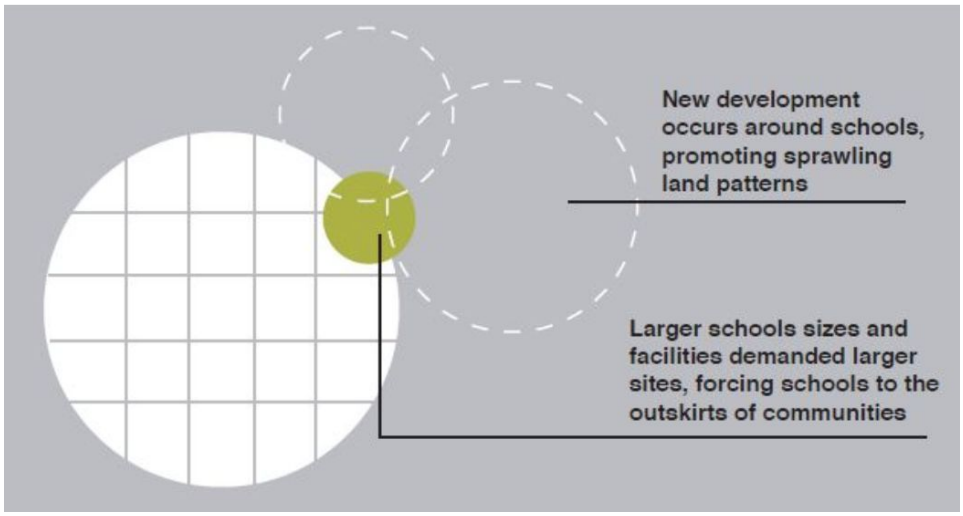

Figure 12: School location trends. Schools are now located on the edge of town which promotes more sprawl.[71]

The Georgia Conservancy has several recommendations to promote state and local sustainable school siting practices including changing current policies, maximizing alternative transportation options, and incentivizing greater coordination within both communities and government.[72]

[71] Georgia Conservancy.
[72] Georgia Conservancy, “School Siting White Paper.”

Interviews

In my research on school facilities, I interviewed several professionals who in some way or another touch school sustainability. Suzanne Haerther is the Director of Education and Membership at the U.S. Green Building Council and was able to give insight into some of the programs USGBC has begun in schools. Stephanie Stuckey is the Director of Sustainability Services at Southface and an Adjunct Professor of Law at UGA. She was the former Director at Atlanta Mayor's Office of Sustainability and was able to give a better understanding of the strengths and weaknesses of the City of Atlanta and their sustainability initiatives. Katherine Moore is the Vice President of Programs and Sustainable Growth Director at Georgia Conservancy and Johanna McCreean, Urban Design Lead at the Georgia Conservancy were able to provide information and research on Georgia school siting requirements and how taxes play a role in determining school locations and quality. Leslie Grant is the Atlanta School Board District 1 elected official. I met Leslie at a community coffee chat where current parents and prospective families were discussing with her their concerns for their local school district. Leslie was able to give an inside look to the current state of schools and the concerns parents have about school facilities. My last interview was with Alvah Hardy II who is the Executive Director of Facilities Services at Atlanta Public Schools. He was able to give insight into some of the challenges APS faces as a government agency. As a whole, these professionals in their field were able to give great insight to the complexities of school facility decisions, design, construction and management.

Suzanne Haerther, USGBC - Educational Sustainability Initiatives
The United States Green Building Council (USGBC) has many educational sustainability initiatives for students, teachers, and school districts. The Center for Green Schools is a program on the national level. USGBC has been looking at the K-12 topic as an opportunity to promote green schools because it has direct links to improving student learning. Studies are being conducted that show green schools are more effective, provide better indoor air quality, and improved daylighting result in improved test scores. USGBC's philosophy increase market demand for green buildings. Haerther explained "kids can't pick their schools, so it's been an area that they need to advocate for as its an equity issue. All schools need to be green schools, not just who can afford to have a green school."

As USGBC continued to study and review K-12 facilities, the more they realized the opportunity to get students involved in green schools to have the greatest impact. The Center for Green Schools has a few tools including an online learning lab where school districts pay for a subscription so teachers can have access to lesson plans on sustainability and school design. USGBC also has a high school level LEED Green Associate which gets students learning about green buildings before they graduate from high school.

Haerther worked with PATH High School in White, Georgia as part of their AP Environmental Education class. The students took on different projects in small groups. One group examined building energy use while another group looked at a trail adjacent to the school. The project was

an application of real world projects which bridged the needs of the school and the community. Another project was school gardens, which was based on the idea of having an outdoor garden and selling the produce to local farmers to engage with the community.

There are school districts that have required buildings to be built to LEED standards. There are 16 LEED certified schools in the City of Atlanta. Northside High School was an old IBM building where they demolished one of two buildings and repurposed the second building for classrooms. The unique facility is changing the school's demographics with a higher population of local students. The students in this part of town previously attended private schools, but after the facility remodel, the school is now a title 1 school.

My interview with Suzanne Haerther provided to be very useful as she provided insight to some of the educational programs USGBC has developed for teachers and students, the ways children are engaging with the built environment through a sustainability lens, and the affect some Atlanta Public Schools are having on their surrounding neighborhood demographics.

Stephanie Stuckey, Director of Sustainability Services at Southface, Former Director at Atlanta Mayor's Office of Sustainability - City of Atlanta's Sustainability Initiatives with Atlanta Public Schools

The City of Atlanta (COA) does not coordinate with Atlanta Public Schools (APS) on the sustainability of educational facilities because the COA is separate from the school district. Stuckey explained that the COA had several efforts to join forces with APS but they ran into road blocks. In conversations with the Office of Sustainability and APS, bureaucratic obstacles in government entities and siloed behaviors made it enormously difficult to create a cohesive sustainability effort with the City of Atlanta and the Atlanta Public School Board. Stuckey expressed trying to work with APS on numerous sustainable initiatives including solar panels on schools, participating in the Atlanta Better Buildings Challenge,

Due to Stuckey's budgetary constraints, she was limited. With that small amount of money, they were able to run the numbers on which buildings from their utility bills made sense for solar installation. The City of Atlanta focused on rec centers because the facilities were controlled by the Department of Parks and Recreation, making jurisdictional boundaries much easier. The Office of Sustainability also received a small grant from the Georgia Environmental Facilities Authority in which they were able to put solar on the Atlanta Beltline and include signage to educate individuals on the amount of solar being generated.

APS has a Director of Sustainability, but the individual was not empowered and after years of trying to do various projects, she left. Stuckey stated, "if they don't empower the position, it's useless. We need political will and leadership that is going to make this to happen." The facilities management level is usually where Stuckey experienced roadblocks where employees were not interested in increasing their workload to include sustainability efforts. Stuckey mentioned that it was having a school superintendent in favor of sustainability that could really push these efforts forward. Stuckey stated "it needs to be an individual in a position of influence

to say “we want it” in combination with that individual empowering someone internally to dog the project. The deputy superintendent is too busy focusing on school performance, grades, graduation rates, and core education to look at sustainability of facilities.”

Looking at other schools as a case study for a successful sustainability model was in Dublin, GA which was a financial disaster and provided an example of how not to do it. The financial structure was the school’s weak point. The City of Decatur is getting a solar array installed in March. This was in collaboration with the Sustainability Citizens Committee that applied for the Georgia Environmental Facilities rebate, which was the same rebate Stuckey applied for the Beltline Solar. The program caps at 60 kilowatts for Renfroe Middle School.

When asked about the potential for a grassroots movement from the parents or the PTA that would support green initiatives, she stated that it could happen, but did not seem convinced that it would do much good. Stuckey gave an example of a school garden initiative called the Captain Planet Foundation that funds school gardens. Another non-profit, Georgia Organics, purpose is to be a farm to table for schools. Stuckey believes they need a partner organization with the skills and the expertise because it’s difficult to navigate the bureaucratic obstacles. Fernbank Elementary school had a green team, a recycling team, and school garden, which are basic level things to initiate. However, initiating higher level sustainability measures such as solar arrays, especially given the regulatory structure of Georgia, we don’t have an RPS, or feed in tariffs, or any incentives at the state level. So trying to navigate financing or how to navigate the regulatory construct is difficult. Private schools have been able to overcome the bureaucratic obstacles and navigate the regulatory construct better than public schools. Another challenge with the financing is that school districts are not non-profit, so they can’t claim any tax incentives from the federal level. Similar to the City of Atlanta, APS would have to go around the bureaucratic obstacles by using third party financing with another entity that could take the tax credit and then pass the savings on to the Atlanta Public Schools, or in Stuckey’s case the City of Atlanta. It is possible, but there are more hurdles to doing so. Stuckey believes doing a solarize program for schools could become cost effective if you could get 20 schools on board. If schools used the solarize program, an outside entity would coordinate the back end , and because there is enough aggregate building stock, there’s enough critical mass to make a profit off of it.

Stuckey’s interview provided to be very helpful as it gave me an inside look into the challenges and obstacles in the City of Atlanta government structure. She was able to provide me with a wealth of information about what policies and programs have and have not worked. I was also able to better understand the goals behind different organizations and their priorities.

Katherine Moore, Vice President of Programs and Sustainable Growth Director and Johanna McCreean, Urban Design Lead at the Georgia Conservancy - School Siting Research
The Georgia Conservancy has worked with the US EPA and a studio through the City and Regional Planning program at Georgia Tech on school siting. Moore and McCreean were able to provide updates on the proposed legislation to lower the school siting requirement. The QBE

Act incentivizes green field development and is not a sustainable way to develop. McCreean stated “whether it’s relocation or new populations, subdivisions follow because they’re next to the super shiney new school, which spurs on further sprawl. As a result, the school serves as the civic/community building because it’s so far away from everything else.” This exemplifies why school siting is vitally important to community planning. Public engagement and citizen participation is not really considered when choosing a school. Most of the decisions get made at the state level.

In 2010/2011 the Georgia Conservancy worked with the EPA to produce school siting guidelines. Under George W. Bush’s guidelines to create schools as emergency centers, the goal was to think holistically about the decisions in school siting. The EPA asked Georgia Conservancy to establish a steering committee on “Train the Trainers” on the School Siting Guidelines. It was designed for school district or to be presented in front of elected officials, and other folks who could empower other folks and tailor it to their needs. It was used in Montana, Denver, and Atlanta. They developed models for school districts, parents, community members, elected officials, and business owners. As part of the training, the Georgia Conservancy does an exercise with highschool students on school siting. They give the students a scenario and use a neighborhood map with 3 possible school sites. In conversation with students, they ask where schools should build, which helps introduce the conversation to students who actually inhabit these spaces.

The Georgia Conservancy is doing a study with the Atlanta Beltline with school siting and using the Atlanta Beltline as the last ½ mile. They looked a schools and transit. McCreean gave an example in Boston where the school district provides their students with a subway pass and D.C. has a free or reduced rate pass for children under a certain age. Another example is in Rome, GA where they looked at the cost of students taking the bus. Now students use the public bus system to get to school. Collaboration with public entities to use schools as multifunctional buildings was explored in a school in Auburn, Georgia which shares the public library with the school. Another example is Drew Charter School in Atlanta, which shares the YMCA facilities.

Moore and McCreean also expressed a concern on the lack of communication between our demographers, city planners, and school facility managers which has lead to a disjointed system. School officials are planning where schools should go and city officials are planning where growth, schools, and other uses should go, but the two entities are not communicating to produce a cohesive plan.

Moore explained that the United States has an enormous existing building stock of public assets that are publicly owned such as pipes, infrastructure, libraries, streets, and buildings. She stated

> “we need to pay attention to the existing building and infrastructure stock. We need to look at how we either retrofit and reuse or reuse the property if the building is too far gone to be reused. It’s reduce, reuse, recycle - it’s the non sexy stuff. We need to think

about reduce, reuse, recycle with these buildings because the sheer volume of these buildings and the land they currently sit on is enormous.We need to correct mistakes with the old stuff, not correcting our mistakes with new stuff. It's ignoring the fact that we already have his huge investment and have already consumed so much land."

Moore mentioned that the fact that the Atlanta Public Schools, and other school districts across the country, own vacant school buildings, tax payer dollars go to mowing the lawns, keeping security patrol, and other maintenance items for old schools that are currently closed. An example of this was located in Dekalb, where the closed Forest Hills Elementary school and Avondale Estates School. It costed over $100,000 a year to maintain a chain link fence, cut grass, and to have a facilities person ensure there were no pipe leaks before it was occupied by The Museum School of Avondale Estates, a charter school. Moore gave another example of a LEED school that was built on a green field. Further education should be given to the officials and professionals that make the decisions for school locations and construction types since our most sustainable places are the ones that already exist.

Decatur has decided to have a walk friendly and bike friendly school system through continued investment. They don't bus as much as other school systems. Granted, Decatur is already a contained city so by virtue of that you're already closer and have been forced to reuse their existing school buildings. The Decatur school system has invested heavily in their crossing guards compared to bus drivers and bus cost. Since Decatur has high quality schools, they also have high home prices and property taxes that feed into the schools budget. As a result of high property values, they are becoming a town of wealthy white people. From a land use and planning perspective they've continued to reuse their buildings and properties. Decatur has heavily invested in being walk and bike friendly.

School budgets are a permissive tax. They can spend as much money as they want to on whatever they want once the taxes go into the school bucket. We as voters don't vote on the school board budget even though the majority of our taxes go to schools. We as voters cannot say that we want schools to be more walk friendly and we don't' want as many school buses. Whereas MARTA cannot do that as they are at the whim of the voters. Whereas Paulding County spends $10/11 million dollars on buses. The way the system is set up, they don't have to tell us. That's the way the state school system is setup. School systems are set up different. Buses can be thought of as a K-12 transit system, so as a City of Atlanta tax payer, you're inherently paying for two transit systems including MARTA and school buses. It's a permissive tax. This compares to a local government that has to come before the residents and ask to establish a splost tax and where it's spent.

Moore and McCreean had similar thoughts as Stuckey about supporting sustainable school development. They mentioned facilities people are looking at cost only, so the leadership has to insist upon high performing buildings from the top down. Innovative schools usually comes from leadership and then the public supports it. There are some isolated incidents across the country for a more grassroots movement to put political pressure on the schools, but in general it needs

to come from the top down. It can't come from the school principal because the principal is an employee of the school system and can be fired by the superintendent. So the power sits with the superintendent and the school board. Where you have a superintendent and their partner government peer (ex: the mayor and APS representatives) say together, if we had quality schools, good buildings, and walkable schools, it would be a sustainable economic driver in our communities. PTA's are more along the lines of a neighborhood association. If they're organized, they can get some small things done, but their impact is limited.

Leslie Grant, Atlanta School Board for District 1 - Background on the politics with schools
I met Leslie Grant on a Saturday morning at a community coffee at one of her monthly meetings open to the community. Grant provided a better understanding of the process students and the school board go through when renovating a school. The moving of students into classrooms is a difficult challenge when some districts already have a high student population. Grant stated that "education plays a major role in turning a community around," which speaks to the importance of sustainable K-12 facilities that are built to last. Grant mentioned that the City of Atlanta Department of Planning used to coordinate with school siting until the 1970's when the City of Atlanta and Atlanta Public Schools split and communication between the two groups reduced drastically.

Alvah Hardy II, Executive Director, Facilities Services at Atlanta Public Schools - Insight to APS
My interview with Alvah Hardy began with a series of questions via email and followed with an in person interview to further expand on the questions in greater detail. The majority of the interview with Alvah is from his email responses, but our conversation has been tied into each of the questions as well. We first discussed the lifespan of a school, which is approximately 50 years, after which demolition and replacement is seriously considered. APS has buildings older than that and cares about roofing and water intrusion and replaces infrastructure to keep the buildings viable for a very long time. The lack of student enrollment causes schools to be abandoned. Demographics change as neighborhoods change. Other external impacts can follow on to our schools. A good example of this was when the Atlanta Housing Authority closed all of their affordable housing inventory. Many of our neighborhood schools lost most of their students. Additionally, small schools are more expensive to operate and like almost everything, it comes down to prioritization of resources. While small schools may be desired for many reasons, it can tax available resources to operate. The APS maintenance budget comes from the General Fund budget with includes all aspects of the school district's operation, all staff salaries, educational programs, student support services, athletics, etc.

The day to day maintenance challenges of school buildings include keeping the campus clean of litter, maintaining cleared storm drains, keeping the roof drains cleared, cleaning the restrooms, and dealing with the unexpected, like students being sick in the classrooms or hallways. That does not take into account keeping up with the major operating systems like HVAC, plumbing fixtures, light fixtures, exhaust fans, kitchen equipment, and life safety equipment like fire alarms, access control, security cameras, fire extinguishers, and fire

sprinklers. The long term maintenance challenges of school buildings are the cleaning and HVAC. Roofing is important and, if ignored, contributes to the detriment of cleanliness and HVAC. The HVAC system uses the most energy in school buildings and is a major consideration when looking at maintenance and replacement when systems are at the end of their life.

Outdoor classrooms or gardens poses challenges such as furry pests looking for food and the question of who is going to maintain the garden. It is not uncommon for a school to have a passionate garden advocate who creates an incredible garden, and then leaves the school. If no one picks up the garden, they quickly fall into disarray and are left to Facilities to clean up. Hardy explained that outdoor classrooms are fine but need to be properly designed, permitted and constructed.

When retrofitting old school buildings, APS has to consider building codes and cost when looking at more environmentally friendly options. All APS buildings are constructed according to codes, including a model energy code that requires the mechanical engineer to model the energy efficiency of the building. Hardy explained that as with everything in life, there are priorities and compromises that have to be made based on the available resources and plans for those resources. All design work is based on current trends in green design. Many green design concepts have become considered the basis of normal design.

Case Studies

Four case studies were completed to understand the current context of what's being done in cities to push school design, sustainable initiatives, and comprehensive school and city planning. The WeGrow school provides a great model for school designs that are pushing the limits of what a classroom is. The Edible School Yard is a program across the globe, that incorporates food education, agriculture, and hands on learning to classrooms. The Primary School for Science and Biodiversity in Boulogne-Billancourt, France is known for its unique school design. The design was inspired by bringing more ecology into the city center by incorporating ecology into the building. Lastly, the Paris Eco Community was chosen for its in depth comprehensive planning efforts which combined education facility planning amongst affordable housing, community gardens, and for using stringent Passive House building standards.

WeGrow School, New York City, NY, 2018

WeGrow is a school for students ages 3-9 in Manhattan, New York City. The school plans to grow further by expanding the student age group to 2-9 in the following year. The WeGrow school's mission statement is "We believe we are all students of life for life and that the whole wide world is our classroom."[73] The school seeks to "undo the compartmentalizalization often found in traditional school environments and reinforces the significance of engaging kids in an interactive environment."[74] The founder and CEO of WeGrow, Rebekah Neumann, is also a founding partner and Chief Brand Officer of WeWork, created the WeGrow school that fosters the growth of humans' minds, bodies, and souls in hopes of improving the world, one child at a time. She carefully chose the word "humans" which identifies her equality point of view of children and adults in the world. The school's program is specifically designed to immerse students with experiences in nature and views the whole world as the classroom. The school works closely with WeWork, a coworking and office space, to immerse students in entrepreneurial environments and stimulate creativity.

[73] WeGrow, "About Us."
[74] Stevens, "Bjarke Ingels Group Opens WeGrow School in New York."

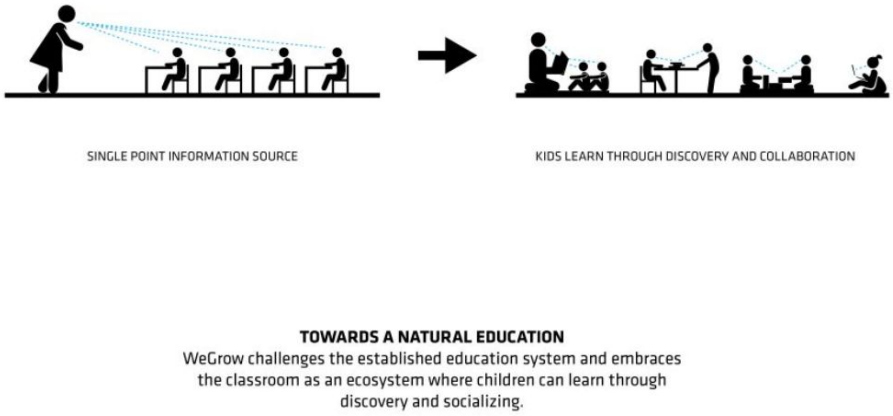

Figure 13: WeGrow School, New York City, 2018.[75]

Accessibility to the school can be viewed by its walkability score, access to public transit, and location to students. The location of WeGrow in the Chelsea neighborhood has a great walkability score and wonderful access to transit, however, the WeGrow school is not accessible for all students. “The school has multiple scholarship programs available and is open to WeWork members, employees, and the local community.”[76]

The architect behind the inspiring designs is Bjarke Ingels Group, or BIG. Bjarke Ingels has joined WeWork as their chief architect. The project was “conceived as a ‘school universe at the level of the child’, the interior comprises a field of super-elliptic objects, which together, form a ‘learning landscape that’s dense and rational -- yet free and fluid.’”[77] The design idea bridges the idea of indoors and outdoors by bringing the natural environment inside making it accessible to students all year round. The modular classrooms, treehouses, acoustic clouds, natural materials, ang neutral colors are all thoughtfully chosen to create an inspiring, calm, and focused learning environment.

[75] Stevens.
[76] Stevens.
[77] Stevens.

Figure 14: WeGrow School, New York City, 2018.[78]

The Edible School Yards Project, Berkeley California

The Edible School Yards project is a program started by Alice Waters in 1995 that focuses on incorporating agricultural and food education into classrooms. The project began as a grassroots effort which included educators, families, farmers, cooks, and artists. The mission behind the Edible Schoolyard Project is "to build and share a national edible education curriculum for pre-kindergarten through high school. Edible education connects the experience of school to the real, lived experience of our students. It prioritizes access to the healthy food that underpins all other efforts to give children a strong start at school and in life."[79]

Figure 15: Edible School Yard, Berkeley, CA.[80]

[78] Stevens.
[79] "Our Story | The Edible Schoolyard Project."
[80] "Our Story | The Edible Schoolyard Project."

They use the Martin Luther King, Jr. Middle school in Berkeley California as a demonstration site for the education and pedagogy. Their model focuses on the garden, kitchen and cafeteria. The cafeteria provides from scratch meals for all public school students with the fresh ingredients from the garden. In the past ten years, Edible School Yard has “trained 897 teachers, community leaders, and parents from over 367 schools worldwide, representing more than 1 million students in 42 US states. The program resource library and network community is completely shared for free. They also offer on site training in Berkeley California for those who are interested in this model.[81]

Figure 16: Edible School Yard, Brooklyn, New York.[82]

The Edible Schoolyard Project can be found across the country, but specifically in Atlanta, Georgia, it can be found at the following schools:

- Jackson outdoor classroom
- Sutton Middle School
- Atlanta Speech School
- Garden Hills Elementary
- Atlanta International School
- Morningside Elementary School
- The Paideia School Farms and Gardens
- The Atlanta School
- The Orion School
- Captain Planet Foundation
- Atlanta Preparatory Academy
- Carver’s Produce Edible Schoolyard
- Grove Park Elementary
- Coretta Scott King Women’s Leadership Academy
- Benjamin E. Mays High School

[81] “Our Story | The Edible Schoolyard Project.”
[82] Lange, “Edible Schoolyard for Brooklyn PS216 by WORKac.”

- South Atlanta Christian Academy
- Feldwood Elementary

The Edible Schoolyard Project is a model that can be used for all schools that have developed with larger set backs and located on larger lots.

Primary School for Science and Biodiversity, Boulogne-Billancourt, France, 2014

The Primary School for Science and Biodiversity was a new construction building located in Boulogne-Billancourt in Paris, France. The building design incorporates a roof-level ecosystem: untamed nature blending with the texture of its residential perimeter which created a multilevel structure with links between spaces and a streamlined contour to create seamless links to encourage biodiversity.[83] "The building becomes a piece of extruded terrain, an elevated landscape where a sheltered native habitat - the urban canopy - can freely evolve, protected by humanity."[84] The building includes 18 classrooms and a large outdoor gym. The school was designed by Chartier Dalix, a local firm in Paris, France.

Figure 17: Primary School for Science and Biodiversity.[85]

[83] Archello, "Primary School for Sciences and Biodiversity."
[84] Chartier-Dalix, "Biodiversity School and Gymnasium, Boulogne Billancourt (92)."
[85] ArchDaily, "Primary School For Sciences And Biodiversity / Chartier Dalix Architectes."

Figure 18: Primary School for Science and Biodiversity, Facade.[86]

This project is great case study as the small design details incorporate urban ecology into the design of buildings. The panels on the building facade are offset to allow for flora and fauna to flourish and start a greater diversity of species seen in cities besides the usual street tree and parks.

Paris Eco Community, Paris, France, 2002-2020
Clichy-Batignolles is an eco-community being constructed in Paris, France. The development started construction in 2002 and is expected to be complete by 2020. Paris was one of the first municipalities to create a climate action plan, which set progressive goals to reduce greenhouse gas emission reductions below the guidelines set by the European Union. The community sets to be a living experiment to see what is possible when focusing on climate sensitive redevelopment.

The site is located on an old train yard and is being turned into an urban park with high efficiency buildings and will eventually house 3,400 residents and provide 12,000 jobs. The project is managed by a public company owned by the City of Paris. By working closely with government officials, the Clichy-Batignolles development exceeds Paris' long standing height limit of 120 feet as 10 buildings reach 160 feet and a special building reaches 520 feet. The purpose of this was to keep building footprints small while also maximizing usable space. The site promotes walking and transit, with limited space for cars.

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The project is developers at Clichy-Batignolles must follow strict guidelines for building energy consumption set by Passivhaus building standards. Passivhaus building standards were developed in Germany as a rigorous energy efficiency standard to reduce the building's ecological footprint by maximizing insulation, using energy efficient window glazing, and strategic building siting toward the sun. Buildings use sustainable design techniques such as green roofs or green walls to add amenities for residents while also adding biodiversity and natural building insulation. This also helps support Paris's Biodiversity Plan. The community also has two community gardens which give residents places to grow their own food and compost food waste as a cyclical agricultural system. The energy used to power Clichy-Batignolles is primarily from renewable sources including geothermal, solar, and wind power.

The development includes residential, office, retail, and other services including four schools, medical services, daycare facilities, gyms, and an activity center for teens. Residential units are designed for varying family sizes and those who live alone including, but not limited to students and elders. Housing units for buyers are priced at various incomes while also including rent capped units.

The project ties technology into the design as well through the European Union's Urban Innovative Actions Initiative. The purpose is to develop smart-grid technology which will help bridge the gap between the theoretical and actual net-zero carbon emissions through a project called CoResponsiblity in Direct Energy Efficiency and Sustainability (CoRDEES).

Figure 19: Paris Eco Community.[87]

The Clichy-Batignolles project relates to sustainability planning in the sense that sustainability plans are holistic. What makes this project so unique is “the complex planning process it pioneered involving disparate stakeholders working in concert to maximize building efficiency and minimize resource use to offer other cities a road map to achieve a low carbon future” (Shmurak, Susannah - ensia article). Stakeholders included architects, urban designer experts, government officials, and environmental engineers who collaborated for years to plan the intricacies of this project. “The City of Paris sought to make Clichy-Batignolles a model for sustainable urban development,” which is why it is so eye catching.

In contrast to current development trends in the US where developers make a majority of the decisions to capitalize on profit, this model focuses on a holistic approach which brings together many players to look at the longevity of projects. This holistic building and development approach really allows for a deeper understanding of who utilizes the project, how to satisfy basic community needs, and a deeper dive into the everyday lives of citizens to optimize building and community functions at a neighborhood scale.[88]

[87] Shmurak, “Paris Is Building the Eco-Community of the Future Right Now. Here’s How.”
[88] Shmurak.

Analysis

The analysis section is broken down into policy and financing, school retrofits, and vacant schools. The analysis takes a critical look at the strengths and weaknesses of the current state of K-12 facilities and will make recommendations for improvements going forward. A broad understanding of what sustainability is and how sustainability concepts can be used to look at the strengths and weaknesses of the K-12 facilities is important to establish. According the the United States Environmental Protection Agency, sustainability is "based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations."[89] The 3 pillars of sustainability are environmental protection, social development, and economic development, so the following analysis will talk about each of these three pillars.[90]

Policy and Financing

While we can imagine many possibilities to retrofit K-12 schools, we must consider the limitations of policy and financing. This is directly tied to the economic development pillar of sustainability, as long term financial planning promotes sustainability. From the information gathered in my interviews, the Atlanta Public Schools budget is determined by the state and the local school system. From that pile of money, APS then allocates money based on the facilities' needs and their required five year facility maintenance plan as part of the Georgia's Capital Outlay Program. Based on the interview with Stephanie Stuckey, there does seem to be a desire to put solar panels on school facilities, however, the main obstacles have been cost and the facility's goals. Since the leadership doesn't include sustainability as one of their primary goals, it then does not get translated as a priority. There is some space for community engagement and citizen participation through the Atlanta Board of Education, however, the . Parents, teachers, and students could benefit from learning about the possibilities of sustainable schools when it comes to design, development, and maintenance as it directly affects the parents' home value and the teaching environment for students and teachers.

Policies need to be developed to encourage future growth, remodeling, and retrofitting schools in Atlanta's western and southern neighborhoods. These neighborhoods are lower income and provide less property taxes to the City of Atlanta and Atlanta Public Schools, which result in less K-12 renovations in this area. Both COA and APS could benefit from improved communication and collaboration. If the City of Atlanta were to promote sustainable, long term development in South Atlanta and West Atlanta, it would reflect in rising home values, attract quality teachers, and give students a higher quality educational facility. In the *State of Our Schools*, we find that "research shows that high-quality facilities help improve student achievement, reduce truancy and suspensions, improve staff satisfaction and retention, and raise property values. They also are integral to ensuring equity in education offerings and opportunities for students."[91] The

[89] US EPA, "Learn About Sustainability."
[90] Mason, "What Is Sustainability and Why Is It Important?"
[91] United States Green Building Council, "State of Our Schools."

importance of building and maintaining high quality schools has a direct impact on our communities. The issue with putting money into abandoned schools leads to a chicken and egg scenario. Do you start with putting money into renovating an abandoned school or do you put money into business development? Good schools have been known to attract families, so if by promoting a walkable, compact, and sustainable development which includes a school from the start, in theory families will follow. This was seen in the Paris Eco Development case study. By promoting walkable development, students could walk to school instead of take the bus which would give students public health benefits as well. Walkable communities also typically have higher commercial values, which in turn promotes further tax revenues for cities and schools. As a result, it's important that COA and APS work together to develop local policies to encourage future growth and development in conjunction with retrofitting schools in Atlanta's western and southern neighborhoods.

Retrofitting Current Schools

The conversation about newly built schools versus retrofit schools really comes down to the size of a city. For example, the City of Atlanta has a lot of underutilized properties and facilities where reusing these facilities and land is optimal. Contrary to landlocked cities like New York City or San Francisco, Atlanta has a plethora of options when choosing a site for a school, which makes it even more critical that they consider the vacant buildings they already own. Cities in suburban areas have even more options to choose greenfield development, however, this is an unsustainable option. Cities and school districts should plan for schools and educational facilities in long range comprehensive plans together. The disconnection was evident in my interviews that the City of Atlanta and Atlanta Public Schools do not communicate on their goals and plans. When cities and schools are able to work together, they are able to incorporate several of their goals including sustainability at the forefront. A good example of this is the Paris Eco Development where a long and drawn out planning process provided for a well thought out community. By tearing down the silos and working together, the professionals behind the Paris Eco Development were able to create a remarkable development. Considering that many of the vacant properties were located in South Atlanta and West Atlanta, this lies a great opportunity for the City of Atlanta and Atlanta Public Schools to work together to plan for and promote development in these areas. As the Atlanta City Design illustrates the large amount of growth the City of Atlanta is expected to have, it would be beneficial for the COA and APS to plan for this growth together.

The City of Atlanta and Atlanta Public Schools could benefit from promoting more sustainable certifications. APS has completed numerous LEED certified schools and continues to encourage sustainable building practices, however, more progressive building options could be perused such as Passive House. The Paris Eco Development used Passive House certifications to pursue a highly energy efficient development which lowered heating and cooling costs, eventually saving the schools money.

In my interview with Stephanie Stuckey, she mentioned the challenges with solar panels on schools. Schools could benefit from state legislation to require solar panels on all schools. By

promoting natural resources for the production of energy from the state level, it would remove the bureaucratic challenges at the local level. Solar is becoming more and more affordable, but the state and local leaders need to make this a priority for it to happen. Stephanie Stuckey previously tried to promote the solarize program, but due to cost burdens and a lack of APS support, was unable to successfully install solar on K-12 facilities. This is a great opportunity for APS to look into since costs for solar are going down and more opportunities for putting energy back into the power grid are happening. The school could be transformed into a true community asset by giving back to the community through clean energy.

Vacant Schools / School Siting

The role of the Atlanta Department of Education, Atlanta Public Schools, and the City of Atlanta has a strong position in sustainability priorities. Since neither of the 3 agencies state sustainability is one of their key goals, there's no real focus on making facilities sustainable. In my interview with Alvah Hardy, it was evident to me that schools focus on the upcoming class size and determine needs on a 5-10 year basis. This limited timeline suggests a pitfall when trying to prioritize for climate change and greater resiliency. This seemed to also be true in the political sector as well. From my understanding, Stephanie Stuckey was limited by the current mayor's priorities. If sustainability, resiliency, and climate change was not in the mayor's goals or part of his or her campaign platform, then it was not going to be a priority during their time in office.

When determining school siting, it depends on the location of the city to provide the best solution and option. All cities should incorporate school facility planning into their comprehensive plans. If a city is landlocked and is pressed for space, the issue become even more pressing that cities have adequately prepared for development. Atlanta Public Schools has a lot of vacant land, so preparing for future development is doable. For APS, it's a matter of using their existing land and buildings in a sustainable way by reusing the structures and making them energy efficient.

The more sustainable practice would be for the City of Atlanta Department of City Planning to collaborate with Atlanta Public Schools on forecasting growth and development in a joint fashion. The City of Atlanta would benefit from providing economic and development incentives to areas where the Atlanta Public Schools have vacant properties, so housing can be built in areas where children have easy and walkable access to schools. If the City of Atlanta is promoting development along the Atlanta Beltline and has economic incentives for developers, then the City of Atlanta and APS can guide development in areas where schools are currently vacant. The collaboration between these entities is really the critical factor that has halted the progression of sustainable development. If the state and local leadership makes sustainability a priority, it would create a major shift in focus for sustainable K-12 development.

Conclusion

Throughout the background research of education and K-12 facility design, the case studies, literature review, and interviews, a comprehensive understanding of the challenges and obstacles that are present when trying to create sustainable communities with schools being at the heart of the community center. The main take away from the research was the disconnection between city planners and school systems. The biggest opportunity for future growth and success of sustainable communities is for Atlanta Public Schools and the City of Atlanta to work together. I was evident that sustainable communities comes from the goals in the city and political leadership. Without the sustainable goals from the top down, it is increasingly more difficult to pursue large scale sustainable retrofits and measures for schools. For the success of sustainable communities around schools, cities, school districts, and politicians need to work together to achieve these goals. The goal and objective of this paper was met as I learned the importance of reusing existing facilities when planning for future student and population growth and how the City of Atlanta and Atlanta Public Schools can work together to achieve this goal.

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